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| Abstract | System requirements document | |
| Purpose | An outline to develop System Requirements for 802.16t | |
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IEEE 802.16t System Requirements Document

July 13, 2020

## Introduction

This document is to summarize the performance requirements for IEEE 802.16 operation in channel bandwidths greater than or equal to 5 kHz and less than 100 kHz. This SRD will act as a guide for the development of an amendment to IEEE Std 802.16-2017. This amendment builds on the 802.16s Amendment completed in 2017 and incorporated in the revision IEEE Std 802.16-2017

The following terminology is used in this document:

SHALL: This word, or the terms "REQUIRED" or "MUST", mean an absolute requirement of the specification.

SHALL NOT: This phrase means an absolute prohibition of the specification.

SHOULD: This word, or the adjective "RECOMMENDED", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.

SHOULD NOT: This phrase, or the phrase "NOT RECOMMENDED" mean that there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.

MAY: This word, or the adjective "OPTIONAL", mean that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation which does not include a particular option MUST be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein an implementation which does include a particular option MUST be prepared to interoperate with another implementation which does not include the option (except, of course, for the feature the option provides.)

# Markets and Use Cases

The following markets and use cases were identified in [IEEE 802.15-20-0108r0](https://mentor.ieee.org/802.15/dcn/20/15-20-0111-00-016t-april-9-2020-teleconference-presentation.pptx)

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| **Market** | **Use Case/Application** | **Sub-Application** |
| Drone | UAS CNPC RADIO LINK |  |
| Oil/Gas | Pump Off Controller |  |
| Oil/Gas | PtP IP Backhaul | LoRa WAN Gateway |
| Electric | PtP Analog Data Circuit replacement | Transfer Trip/EMS SCADA |
| Electric | Advanced Metering Infrastructure (AMI) |  |
| Electric | Volt/VAR Control (Capacitor banks) |  |
| Electric | Distribution Feeder Automation |  |
| Electric | Circuit Sensors |  |
| Electric | Advanced Solar Inverters |  |
| Electric | Remote Fault Indicators |  |
| Water | SCADA |  |
| Electric | Substation Monitoring Devices |  |
| Electric | Field Devices | Reclosers, Fault Circuit Indicators (FCIs), Switches, Access Points |
| Electric | AMI Collector |  |
| Electric | Substation |  |
| Electric | Distribution Sub SCADA |  |
| Electric | Distribution Sub Metering |  |
| Electric | AMI |  |

The standard should support this set of use cases for field area networks, and similar critical infrastructure industry applications, that require high reliability and availability.

## 802.16t Amendment Requirements

Amendment Requirements that must be specified in the amendment in order to meet the operational requirements. These requirements identify the gaps in the existing standard that must be addressed by the amendment in order to attain those capabilities.

**Topology:**

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**Frequency Range**

See [IEEE 802.15-20-0055-03-016t-frequency-band-layout.xls](https://mentor.ieee.org/802.15/dcn/20/15-20-0055-03-016t-frequency-band-layout.xlsx)

(Proposed in 802.15-20-0050r0)

Operation in paired or unpaired continuous licensed bands available for private networks (e.g., AMTS, IVDS, 454 A2G, 700 MHz A-Block, RR 900 MHz, 1.4 GHz).

* Support for partition of these bands into multiple channels is required for frequency reuse and link budget/coverage considerations.

Operation in Private Land Mobile Radio (PLMR) bands (e.g., RR160 MHz).

* PLMR channels in the VHF band are available worldwide.
* Common PLMR channel bandwidth: 6.25, 12.5, 25 and 50 kHz
* Special PLMR channel bandwidth: 5, 7.5 and 15 kHz
* Multiple adjacent or non-adjacent PLMR channels in the same band will be combined to support higher throughput services.
* Support of voice/data coexistence in low utilization voice channels. Voice will have priority over data.

**Channel BW Range**

From PAR: “The amendment defines operation for channel bandwidths greater than or equal to 5 kHz and less than 100 kHz.”

Operation above 100 kHz is already supported.

**UL/DL Ratio**

The standard shall support configurable UL/DL ratio. The range of configuration should be 10:1 to 1:10

**Duplexing Requirements TDD or FDD**

(Proposed in 802.15-20-0050r0)

TDD will be used in unpaired spectrum and in paired spectrum if allowed by the applicable regulation authority. A highly asymmetrical or reverse asymmetrical DL:UL ratio (e.g., 1:10 to 10:1) should be supported.

Typical IoT application is highly reverse asymmetrical.

HD-FDD or FDD will be used in paired spectrum if TDD is not allowed

FDD will be used in paired spectrum if the latency requirements cannot be satisfied by TDD

**Modulation and Coding Scheme:**

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**Mobility:**

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**BS to BS Handoff:**

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**One-way Latency and Operational throughput:**

(Proposed in 802.15-20-0050r0)

Throughput and latency requirements per endpoint:

* Many endpoints run low throughput non-critical latency applications. They should be served by low-end remote stations.
* Some endpoints run substantial throughput and sometimes also low latency applications. They should be served by high-end remote stations.

The air interface protocol will support concurrent operation of both low-end and high-end remotes on the same sector / base station

Low-end remote station specific requirements

* Limited throughput, Limited total bandwidth, Low power consumption, Low cost

High-end remote station specific requirements

* Support high throughput over relatively high total bandwidth. Supports low latency for time critical applications.

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**Predictable Performance:**

(Proposed in 802.15-20-0050r0)

Licensed band (mandated by the PAR)

Central scheduling

QOS

High Security

**Range (DL or UL) and Coverage Requirements:**

(Proposed in 802.15-20-0050r0)

Long range single hop coverage (e.g., up to 50+ miles cell radius):

Receiver sensitivity requirement

TDD frame structure requirements

Support of repeater for range extension (?)

**Endpoints:**

(Proposed in 802.15-20-0050r0)

Support for 1000’s of endpoint devices per sector (known as “massive connectivity”) in a Point to Multi-Point architecture

An example of massive connectivity requirement includes rapid reconnection of all remotes in a sector after a base station failure has occurred.

**Throughput maximization, reduction of overhead:**

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**Permutation:**

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**Advanced Antenna Systems:**

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**Management / MIB**

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**Cyber Security**

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